THE June number of *Biometrika* contains an interesting contribution to the discussion on Mendel's theory of inheritance by Prof. Weldon, in which further difficulties are put forward against the acceptance of the laws as interpreted and amended by Mr. Bateson. Mr. Darbishire gives, in the same number, his third record of the hybrids between waltzing mice and albinos, and Mr. Woods an account of his experiments in breeding rabbits as bearing upon the principles of the same theory. Among other interesting papers there will be found what appear to be preliminary attempts on the part of Mr. Geoffrey Smith to determine the mass relations of nucleus and cytoplasm in Actinosphærium, and of Dr. Warren to determine the relationship between the size of the cell and the size of the body in Daphnia. Further work in this very interesting but difficult field of research is much needed.

THE North American representatives of the widely spread group of diminutive ants, known as Leptothorax, are revised by Mr. W. M. Wheeler in the *Proceedings* of the Philadelphia Academy (pp. 215 *et seq*). The small size and concealed position of the colonies of these ants (which in general contain only from 25 to 50 individuals) account to a great extent for our imperfect knowledge of the group.

IN the June number of the *American Naturalist* Prof. B. Dean records partial and complete albinism, as well as polychromatism, in the hag-fishes. Since one species of the group is thus proved to possess a definite type of coloration, it is inferred that myxinoids, as a whole, can scarcely differ in this respect from true fishes, in which deep-sea forms are uniformly coloured, while shallow water types are variegated. Hence follows the further inference that the few existing forms are survivors of a once numerous tribe. Later on in the same issue Mr. C. J. Herrick discusses the sense-organs in the skin of fishes, and concludes that those species which possess terminal nerve-buds in the lateral line system of the outer skin detect and taste their food by means of these organs, while those which lack these structures in the skin have the sense of taste confined to the mouth.

AN extremely suggestive and interesting paper by Dr. Lewkowitsch, dealing with problems in the fat industry, appears in the *Journal* of the Society of Chemical Industry, vol. xxii. No. 10. The author is of the opinion that a fresh wave of inventive activity is approaching in the various branches of the fat industry, and in his paper points out a series of problems which await solution at the present moment. Industries having for their object the refining of fats and oils, industries in which the glycerides undergo a chemical change but are not saponified, and those industries based on the saponification of fats and oils, are all dealt with in the paper.

THE additions to the Zoological Society's Gardens during the past week include a Sooty Mangabey (*Cercocebus fuliginosus*), a Black Hornbill (*Sphagolobus atratus*) from West Africa, presented by Mr. T. Wright; two Arabian Gazelles (*Gazella arabica*) from Sheik Osman, Arabia, presented by Messrs. Wheatley and Glossop, R.N.; a Brazilian Tapir (*Tapirus americanus*) from South America, an Amazonian Manatee (*Manatus inunguis*) from the River Amazon, presented by Mr. Charles Booth; a Grey Squirrel (*Sciurus cinereus*) from North America, presented by the Lady Kintore; a Campbell's Monkey (*Cercopithecus campbelli*) from West Africa, a White Stork (*Ciconia alba*), European, deposited.

OUR ASTRONOMICAL COLUMN.

BRIGHT SPOTS ON SATURN.—Mr. W. F. Denning sends us the following approximate times of transit of two bright spots across the central meridian of Saturn, and the times of rising and southing of the planet during the next fortnight:—

1903	Spot "A" h. m.	Spot "B" h. m.	Saturn Rises h. m.	Saturn Souths h. m.
July 25	10 37	—	8 5	12 25
,, 26	—	14 18	8 1	12 21
,, 27	13 47	10 43	7 57	12 17
,, 28	10 12	—	7 53	12 13
,, 29	—	13 53	7 49	12 8
,, 30	13 22	10 18	7 45	12 4
,, 31	9 47	—	7 41	12 0
Aug. 1	—	13 28	7 36	11 56
,, 2	12 57	9 53	7 32	11 52
,, 3	9 22	—	7 28	11 47
,, 4	—	13 3	7 24	11 43
,, 5	12 32	9 28	7 20	11 39
,, 6	8 57	—	7 16	11 35
,, 7	—	12 38	7 12	11 31
,, 8	12 7	9 3	7 8	11 26
,, 10	—	12 13	7 0	11 18

The spots are separated by about three hours (=108°) of longitude, and are conspicuous objects when the planet is well defined.

SPECTROSCOPIC OBSERVATIONS OF NOVA GEMINORUM.—Photographs obtained in April by Prof. Perrine, using the Crossley reflector, show that, despite its reddish colour, the light from Nova Geminorum was rich in actinic rays. They do not show any trace of nebulosity around the star such as was obtained in the case of Nova Persei.

Spectrograms obtained with the small slitless spectroscope attached to the Crossley reflector, show that in the region photographed—$H\beta$ to λ 335—the spectrum somewhat resembles that obtained by Messrs. Wright and Campbell for Nova Persei in April, 1901, and consists of bright lines and bands superposed on a continuous spectrum; these lines are almost all accounted for by the hydrogen lines in that region. $H\epsilon$ and $H\zeta$, as well as the lines at λ 339 and λ 346, were the strongest lines in Nova Persei, but they are very weak in the recent Nova, whereas $H\beta$ and $H\delta$ are strong in the latter but very weak in the former spectrum; the chief nebular line, λ 501, which was conspicuous in the spectrum of Nova Persei, is not shown in these spectrograms of Nova Geminorum. These differences may be due to the different stages of development of the two stars.

A comparison of two spectrograms obtained on April 2 and 8 respectively, show a considerable alteration in the six days interval, particularly in the ultra-violet region, where the continuous spectrum became weaker and the bands at $\lambda\lambda$ 350, 374 and 384 consequently appeared stronger; λ 339 and λ 346 also appeared to have developed. $H\beta$ appeared weaker, and there was a faint condensation in the region of λ 501. This condensation appeared as a fairly well-marked line on a later photograph obtained on May 11. Visual observations showed a strong $H\alpha$ line and a condensation in the region about D_1 and D_2.

An ordinary photograph exposed on April 22, 23 and 24 for 6h. 29m. showed no trace of nebulosity around the Nova.

Reproductions of these region photographs and spectrograms, and a detailed account of the visual and photographic observations of Profs. Reese and Curtis accompany Prof. Aitken's article in Lick *Bulletin*, No. 37.

MEASUREMENT OF THE INTENSITY OF FEEBLE ILLUMINATIONS.—M. Touchet, of Paris, has devised an apparatus for measuring the intensities of such feeble illuminations as the Zodiacal Light and the Gegenschein. It is similar in appearance to a theodolite, but has a flame of constant illuminating power so arranged as to illuminate the field through a variable slit. This slit may be opened and closed, like the slit of an ordinary spectroscope, by a screw having a divided head, so that the intensity of the field illumination may be instantly made equal to that of the light it is desired to measure, and readings, which are reducible to a standard, thus obtained (*Bulletin de la Société Astronomique de France*, July).

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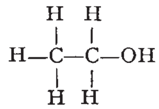
THE GERMAN ROYAL NAVAL OBSERVATORY.—The twenty-fifth annual volume (1902) of the publications of this observatory, entitled "Aus dem Archiv der Deutschen Seewarte," contains descriptive papers on "The Regulation of Marine Compasses," "A New Free-horizon Astronomical Base Line," "The Definitive Determination of the Path of the Comet Swift (1899.I)," and "The Results of Sextant Tests made at the Observatory.

In addition to the introduction, Dr. Neumayer, the director, contributes an article on "A New Method of Forecasting the Meteorological Conditions of the North Atlantic Ocean," and a novel chart, indicating all the meteorological conditions obtaining in the North Atlantic area during March, 1902, accompanies the volume.

RECENT ADVANCES IN STEREOCHEMISTRY.[1]

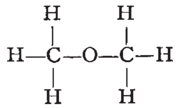
IN the year 1803, just a century ago, John Dalton delivered a series of scientific lectures in the Royal Institution during the course of which he doubtless laid before his audience a theory which he had recently devised for the purpose of connecting together the vast number of isolated chemical facts known at the commencement of the nineteenth century. This theory, of which the centenary is being celebrated during the present month by the Manchester Literary and Philosophical Society, is known as the atomic theory, and was destined to form the foundation upon which the whole superstructure of modern chemistry has been built. For our present purpose Dalton's theory may be briefly stated in the form of the following two principles:—(1) Every element is made up of homogeneous atoms of which the mass is constant; (2) chemical compounds are formed by the union of atoms of the various elements in simple numerical proportions. In accordance with Dalton's hypothesis, chemical substances may be mentally pictured by imagining the atoms as small spheres which have the power of aggregating themselves together under suitable conditions to form complexes or "molecules"; thus, taking two similar spheres representing hydrogen atoms, in conjunction with a sphere of a different kind, representative of an atom of oxygen, a chemical representation can be given of the compound water, the molecule of which is composed of two atoms of hydrogen and one of oxygen. The original atomic theory offers no explanation of the observed fact that the atoms combine together in different proportions; this deficiency was remedied by the doctrine of valency enunciated by the late Sir Edward Frankland in 1852. Frankland supposed that the atoms of certain elements, such as hydrogen and chlorine, are unable to combine with more than one atom of any other element; these elements are termed monovalent. Other atoms, such as those of barium and zinc, can become directly attached to at most two other atoms; these are the divalent elements. Tri-, tetra-, penta-, hexa-, hepta- and octa-valent elements can be similarly distinguished, the valency of hydrogen being taken as unity, in order to measure and define the saturation-capacity or the atom-fixing power of the atoms of the other elements. It will be clear that for rough diagrammatic purposes we may provide the spheres representing the atoms with as many wooden pegs as the element itself exhibits units of valency; compound molecules can then be represented by fitting the atoms together by means of the pegs representing the number of valency-units possessed by the various constituent atoms. By so doing a great advance is made upon the atomic theory of Dalton's time, and a mental picture is obtained of the way in which the atoms are connected together within the molecule itself.

During the early part of the nineteenth century it became evident, principally from the work of Liebig and Wöhler in Germany, and of Faraday at the Royal Institution, that substances exist which possess totally different properties, but nevertheless have the same molecular composition; as this became slowly realised, the atomic theory was naturally called upon to furnish some adequate explanation. In view of the proven identity of molecular composition, the required explanation could only be sought for in differences in the atomic arrangement within the molecules of the several substances. That such differences can be successfully illustrated by the aid of the atomic models will be seen on considering some specific case. Ordinary ethyl alcohol and methyl ether differ greatly from each other—the first is a liquid, whilst the second is a gas at ordinary temperatures—but possess the same molecular composition, the molecule in each case consisting of two atoms of carbon, six of hydrogen and one of oxygen. These two substances have to be represented on the assumption that hydrogen is monovalent, carbon tetravalent, and oxygen divalent. By joining wooden spheres together in the order shown in the figures—in which the valencies of the component atoms are carefully respected—diagrammatic representations are obtained which illustrate to the chemist the differences existing between ethyl alcohol and methyl ether.



$$\begin{array}{ccccccc} & & \mathrm{H} & & \mathrm{H} & & \\ & & | & & | & & \\ \mathrm{H} & — & \mathrm{C} & — & \mathrm{C} & — & \mathrm{OH} \\ & & | & & | & & \\ & & \mathrm{H} & & \mathrm{H} & & \end{array}$$

Ethyl Alcohol.



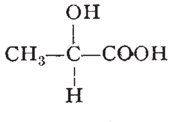
$$\begin{array}{ccccccccc} & & \mathrm{H} & & & & \mathrm{H} & & \\ & & | & & & & | & & \\ \mathrm{H} & — & \mathrm{C} & — & \mathrm{O} & — & \mathrm{C} & — & \mathrm{H} \\ & & | & & & & | & & \\ & & \mathrm{H} & & & & \mathrm{H} & & \end{array}$$

Methyl Ether.

Substances related to each other in this way are said to be isomeric; they have the same molecular composition, but different molecular constitutions. The step in advance which is involved in thus writing molecular constitutions or in constructing molecular models was taken by Kekulé in 1858.

Two great stages in the development of chemical theory have now been indicated. First, that contributed by Dalton, who regarded constancy of molecular composition as characteristic of a chemical substance; secondly, that further stage, attained as a result of the labours of Liebig, Wöhler, Faraday, Frankland and Kekulé, which involved the introduction of the idea that the chemical individuality of a substance is dependent upon its molecular constitution as well as upon its molecular composition. A third great development in the atomic theory had yet to take place.

Whilst the theoretical views which culminated in Kekulé's constitutional formulæ were at first found sufficient to explain numerous observed cases of isomerism, instances soon began to accumulate of substances which exist in so many isomeric forms that the Kekulé method of representation is incapable of accounting for them all. At an early date Pasteur showed clearly that substances exist which have the same molecular composition and the same molecular constitution, but which nevertheless differ in important respects. A crisis was ultimately reached when, in 1870, Wislicenus demonstrated the existence of three isomeric lactic acids, all having the molecular composition $C_3H_6O_3$, and the molecular constitution



$$\begin{array}{ccccc} & & \mathrm{OH} & & \\ & & | & & \\ \mathrm{CH_3} & — & \mathrm{C} & — & \mathrm{COOH} \\ & & | & & \\ & & \mathrm{H} & & \end{array}$$

and contended that he had amply proved the insufficiency of Kekulé's method of writing constitutional formulæ.

The step needed to rid the atomic theory of these apparent anomalies was indicated by van 't Hoff and Le Bel in 1874; they pointed out that the weakness of the Kekulé method lies in the tacit assumption that the molecule is spread out upon a plane surface, and that by throwing this assumption aside and taking a rational view of the way in which the molecule is extended in space, all difficulties immediately vanish. The considerations put forward by van 't Hoff and Le Bel form the basis of the subject now known as stereochemistry, the branch of science which deals with the manner in which the atoms are distributed within the molecule in three-dimensional space; they deal, in the first place, with the arrangement of the constituent atoms in the simple organic compound, methane, the molecule of which has the composition CH_4, or consists of one carbon atom and four hydrogen atoms. The Kekulé constitutional formula pictures the component atoms of the methane molecule as if joined together in one plane (Fig. 1), whilst according to the new view, the four hydrogen atoms are imagined situated at the four apices of a regular tetra-

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[1] A discourse delivered at the Royal Institution on May 1 by Prof. William J. Pope, F.R.S.

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